



## Natural Heritage & Endangered Species Program

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**Description:** Jefferson salamanders are long and slender salamanders with elongated limbs and toes. They are grayish brown to dark brown in color with a lighter bluish gray underside. Often there are pale bluish or silvery flecks on the limbs and lower sides of the body and tail.

Determining sex is easiest done during the breeding season, when males have conspicuously swollen vents and females appear less slender than males due to the burden of their eggs. Additionally, males are slightly smaller in length and range from 4.4 to 7.4 inches (11.0 to 18.5 cm) with a strongly laterally compressed tail that comprises approximately 50% of the total length; females range 5.1 to 7.8 inches (12.9 to 19.6 cm) in total length and have slightly shorter, non-compressed tails.

The larvae are difficult to distinguish from other *Ambystoma* species, but have short stubby bodies and very large heads with an unpigmented throat and chin. The backs of larvae are marked with pairs of black spots separated by a mid-dorsal black line, and the sides of their bodies are marked with a mid-lateral row of lighter spots.

**Similar species:** The Jefferson salamander is a member of the Jefferson / Blue-spotted complex salamander (*A. jeffersonianum* / *A. laterale* complex). Blue-spotted (*Ambystoma laterale*) and Jefferson salamanders were separated by ice age glaciation, but after the ice melted, the two species came into contact with each other and began interbreeding producing hybrid populations. The hybridization of these two species has led to the development of two completely female populations that are all polyploids – that is, they have multiple sets of chromosomes rather than the normal set of two (diploid). Although Jefferson salamanders and blue-spotted salamanders are fairly easy to differentiate from each other, the identification of the hybrid species is very difficult to distinguish on the basis of appearance alone; typically,

## Jefferson Salamander *Ambystoma jeffersonianum*

State Status: **Species of Special Concern**  
Federal Status: None



Photo by Bill Byrne

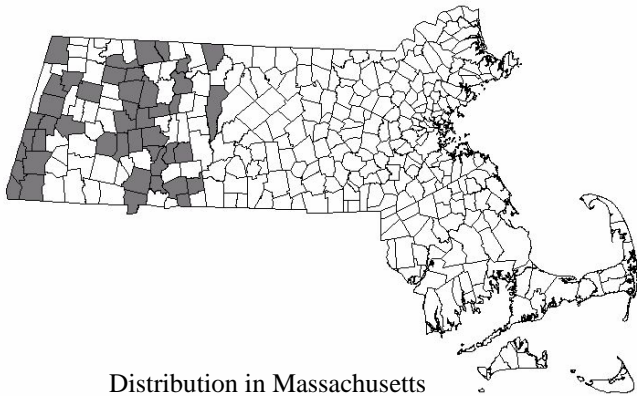
identification can only be completed through chromosome counts or size of red blood cells in conjunction with their external appearance. Even though, these two hybrid populations have been formally named as the Silvery salamander (*Ambystoma platineum*) and the Tremblay's salamander (*Ambystoma tremblayi*), the hybrid salamanders are simply referred to as the Jefferson / Blue-spotted complex salamander.

When the Jefferson / Blue-spotted complex hybrids are present in an area, they may outnumber the blue-spotted or Jefferson salamanders by a 2:1 margin. A population with many more females than males is a good indicator of the presence of hybridization of these species. The mode of reproduction of the female hybrids is gynogenesis: sperm is obtained from male diploids to stimulate egg division, but no genetic recombination occurs. However, additional hybrid forms such as triploid males and tetraploid and diploid females have been found, indicating that some offspring retain genetic material from two parents.

The members of the complex form a continuum in appearance from the grayish-brown coloration, pale blue flecks, and wide snout of the Jefferson salamander to the bluish-black coloration, prominent blue spots, and narrow snout of the blue-spotted salamander.

**Range:** The ranges of the Jefferson and blue-spotted salamanders overlap in New England. Populations of pure Jefferson salamanders therefore occur south of the hybridization zone with blue-spotted salamanders. The area of populations of pure Jefferson salamanders and hybrids extends from southern New York, northern New Jersey, and most of Pennsylvania to Ohio and southern Indiana. The range extends southward only as far as Kentucky, West Virginia and Virginia.

In Massachusetts, Jefferson salamanders occur predominantly within the western part of the state. In general, Jefferson - blue-spotted complex salamanders found west of the Connecticut River are more likely to be Jefferson salamanders.



Distribution in Massachusetts  
1980 - 2006

Based on records in Natural Heritage Database

**Habitat:** Jefferson salamanders have a strong affinity for upland forests and prefer to reside most of the year in well drained deciduous or mixed forest, within 250 to 1600 meters of a small vernal pool or pond, commonly surrounded by alder, red maple, buttonbush, and dogwood. They hide beneath leaf litter, loose soil, and stones, or in rotting logs, rodent burrows, or subterranean burrows which they excavate. Vernal pools, or temporary ponds, are necessary for reproduction and need to be full of dead and decaying leaves for cover and overhanging bushes or grass for egg deposition. Abandoned, fishless farm ponds with cattails and other vegetation are good sites for breeding populations.

**Life Cycle / Behavior:** Jefferson salamanders hibernate underground in the winter months, usually near breeding sites. In March and April (sometimes as early as February), Jefferson salamanders begin to migrate to breeding ponds which is thought to be triggered by the first early warm spring rains or other

conditions of high humidity and above-freezing temperatures. They congregate in large numbers at temporary ponds with males arriving to breeding sites a few days prior to females. An elaborate courtship, similar to the blue-spotted salamander, occurs including approach, contact, nudging, and tail-fanning routines that take place in the water between a single male and single female. Following a period of amplexus, the female will follow the male, pick up a deposited spermatophore, and store it in the cloaca for egg fertilization. (Normal sexual reproduction occurs in the diploid females, while no true fertilization or recombination of chromosomes takes place in the triploid hybrids). One to two days after mating, the females deposit their eggs at night (or during the day if cloudy and rainy) on submerged branches, aquatic plants, or tree limbs dipping into the water. The eggs are deposited in small masses which average 16 in number, but can vary from 1 to 60; 100 to 286 eggs are laid in all. The eggs hatch in 30 to 45 days, and the larval stage ranges from 56 to 125 days. Larvae are cannibalistic and are voracious eaters, preying on insect larvae and other small aquatic animals. No overwintering of larvae has been reported in Massachusetts, so by late August larvae have metamorphosed completely into air-breathing adults.

Jefferson salamanders have been found to migrate to and from breeding pools an average of 100 to 900 feet from their terrestrial habitat. The maximum known movement distance of an adult is 5249 feet (1600 m) in Ohio.

Adult Jefferson salamanders are rarely seen outside of the breeding season, but are presumed to eat earthworms and other invertebrates underground. They produce noxious skin secretions from specialized poison glands in their tail and are thus rarely preyed upon by native predators.

**Population status in Massachusetts:** The Jefferson salamander (including triploid and other polyploid forms within the *A. laterale*/*A. jeffersonianum* complex) is currently listed as a "Species of Special Concern" in Massachusetts. There are 47 towns in Massachusetts where Jefferson salamanders have been observed. Seventy-four occurrences have been documented since 1981, as well as 11 historic occurrences that were documented prior to 1981. The major threat to this species—and most salamanders in general—is the loss, degradation and fragmentation of both aquatic breeding pool habitat required for reproduction and terrestrial habitat needed for foraging, overwintering, growth and development to development and urbanization. Some

population declines may be attributed to over collection, heavy road traffic, and pesticides or other toxic chemicals polluting breeding pool water.

Studies on the effects of acid rain on salamander eggs and larvae have been contradictory, and further studies must be made to resolve this issue; however, it appears that Jefferson salamanders appear to be more vulnerable to acidic conditions than other salamanders in New England and have complete egg mortality at low pH levels and water of pH < 4.5 is often lethal to larvae.

**Management Recommendations:** In order to ensure the survival of this species in Massachusetts, the following recommendations regarding habitat preservation are suggested. There are two critical components in the life history of this species: vernal pool habitat required for reproduction and upland forest habitat required for foraging, hibernation, and other terrestrial and fossorial activities. Conservation of the Jefferson salamander—and all native members of the genus *Ambystoma*—must therefore focus on the preservation of vernal pools and small ponds known to be inhabited by this species, as well as a significant parcel (250–1600 meter radius) of upland habitat surrounding such breeding sites. Provided these habitats are not significantly degraded—and that the salamanders are not subject to illegal collection or high road mortality—the salamander populations should be capable of maintaining themselves indefinitely.

It should be kept in mind, however, that every population is unique. The majority of the population, for instance, may be concentrated in a relatively small and discrete upland habitat, which would safely allow carefully conducted development within some portions of the “uninhabited” habitat around the breeding pool without serious effects on the population. The only way to determine if such a case exists, however, is through a detailed environmental study conducted by a qualified researcher(s) over a series of years, charting the movements of the animals to and from the breeding site. Unless such a study is conducted, it should be assumed that the salamanders are relatively evenly distributed around the pool and development should be strongly discouraged within a minimum radius of 500–1,000 meters surrounding the breeding pool.

Vernal pools and breeding ponds must be protected not only from draining, filling, and development, but also from degradation in the form of road and lawn run-off. If forestry activities are conducted within surrounding areas, a no-cut buffer zone of 50–100 feet should be established around the pool depression, and no slash or other debris should be dumped in the depression. While vernal pools receive some protection under the Massachusetts Wetlands Protection Act, and several vernal pool species (including the blue-spotted salamander) are protected under the Massachusetts Endangered Species Act, efforts should be made to certify all vernal pools and to enhance and promote the enforcement of the laws mentioned above. Because of their ephemeral nature, vernal pools are often difficult to locate during dry periods and may be inadvertently damaged if their locations are not surveyed and marked prior to forestry or construction operations.

Citizens must be encouraged to recognize and report Jefferson salamanders and the locations of their breeding pools. Due to the rarity of this species, its ephemeral terrestrial occurrence, and its very specific habitat requirements, some populations undoubtedly remain undiscovered and therefore under protected.

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